NFESC Project Success

Photolytic Destruction Technology for Chlorinated and Petroleum Hydrocarbons

The Naval Facilities Engineering Service Center (NFESC) and Southwest Division (SWDIV) demonstrated an innovative installation restoration project at Site 9 at NAS North Island. The project is photolytic destruction technology for the remediation of chlorinated and petroleum hydrocarbons. This remediation project was being completed under the Broad Agency Announcement Program (BAA) and the Navy Environmental Leadership Program (NELP).

Project Summary

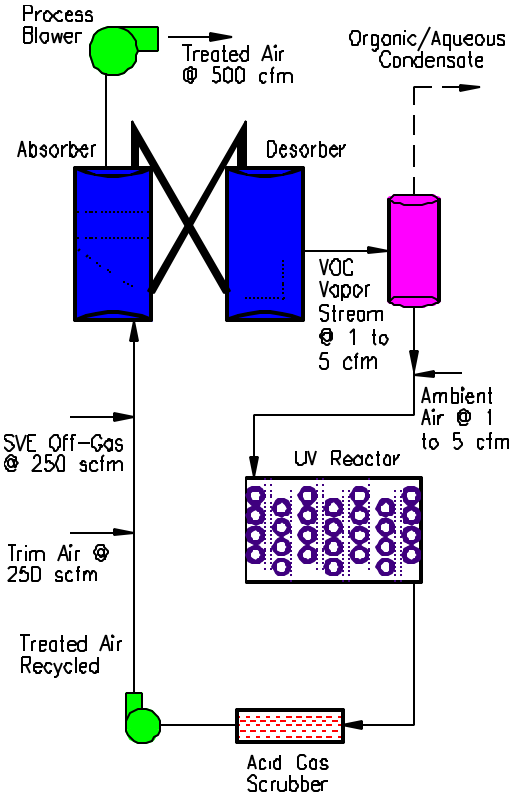
NAS North Island Site 9 is located across San Diego Bay from the City of San Diego. Trenches at Site 9 have historically been used for the disposal of chlorinated solvents, caustics, acids, and ceramic and metallic compounds. Eighteen specific volatile organic compounds (VOCs) and carbon dioxide have been identified in the exhaust vapor of the existing soil vapor extraction (SVE) system. Process Technologies, Inc. (PTI) was selected by SWDIV to use "photolytic destruction (PD)" for removal of VOCs from the exhaust of the SVE system.

Photo-chemical oxidation of VOCs mimics the natural process of breaking down ozone-depleting chemicals in the stratosphere. As the light wavelength decreases, or becomes shorter than that of visible light, the energy level of the photons increases. Short-wavelength photons (UV light in the 170 to 254 nm range) are capable of efficiently destroying halogenated hydrocarbons. The bonds between the hydrocarbon chains are broken and the molecules are left in a "free radical state".

Breakdown products and acids produced in the photolytic reactor are controlled through the use of a reagent panel which chemically reacts with gaseous breakdown products forming solid, stable products (Figure 1).

Field Demonstration Phase

The PD demonstration was completed within an eight-month period. Remediation was performed on vapor phase contaminants at Site 9 through a series of treatment steps. These steps involved the use of a "Concentration Unit" and a "Photolytic Reactor" as follows:



Photolytic adsorber tank

1. The Concentration unit consists of a fluidized bed adsorber/desorber unit, which consolidates organics up to 1000 times their original concentration while maintaining a low flow vapor stream. The flow rate was 250 scfm.
2. The concentrated vapor stream was treated in the photolytic reactor with ultraviolet (UV) lamps.
3. The reaction by-products were stabilized with a reagent composed primarily of calcium hydroxide. The resulting compounds are stable salts, such as calcium chloride.
4. The spent reagent did not exhibit any characteristic of a hazardous waste and was used as feedstock for cement production.

Process equipment

VOC Off Gas Treatment Technologies Database Main Menu

Choose Desired Development Status: All | Mature | Developing | Emerging

Treatment Technologies:

UV Oxidation ▼

Technology Profile

View Schematic

Pros & Cons

Typical Unit Cost for UV Oxidation

Flow Rate	500 ppm	1000 ppm	2000 ppm
1000 cfm	$ 9.11	$ 6.74	$ 4.81
2000 cfm	$ 5.57	$ 4.24	$ 3.15
3000 cfm	$ 4.39	$ 3.41	$ 2.60

View Systems for Technology Selection

Unit Cost Estimation

Web based interactive database

Equipment trailer

Project Successes

The project was successful in destroying VOC's using photolytic technology. The technology was demonstrated to be a viable technology for DOD facilities.

NFESC also utilized an innovative contracting procedure whereby the contractor was paid on both a fixed price and a reimbursable basis. The contractor was paid a fixed price for mobilization and startup costs, but paid only on a reimbursable basis (by pound of contaminant destroyed) for operational costs. As a result, the actual project cost was only 50% of the original estimated project cost. The contract was awarded within 30 days and mobilization had begun within 60 days.

In addition, the data gathered during the project was entered into the remediation technology database, which is posted on the NFESC web site. This interactive database compares cost, implementation complexity, soil characteristics, and other parameters so that users can quickly screen remediation technologies for their sites.

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